

Abstract

UID...Now That's Gonna Leave A Mark

Since 1975 bar codes on products at the retail counter have been accepted as the standard for entering product identity for price determination. Since the beginning of the 21st century, the Data Matrix symbol has become accepted as the bar code format that is marked directly on a part, assembly or product that is durable enough to identify that item for its lifetime. NASA began the studies for direct part marking Data Matrix symbols on parts during the Return to Flight activities after the Challenger Accident. Over the 20 year period that has elapsed since Challenger, a mountain of studies, analyses and focused problem solutions developed by and for NASA have brought about world changing results. NASA Technical Standard 6002 and NASA Handbook 6003 for Direct Part Marking Data Matrix Symbols on Aerospace Parts have formed the basis for most other standards on part marking internationally. NASA and its commercial partners have developed numerous products and methods that addressed the difficulties of collecting part identification in aerospace operations. These products enabled the marking of Data Matrix symbols in virtually every situation and the reading of symbols at great distances, severe angles, under paint and in the dark without a light. Even unmarkable delicate parts now have a process to apply a chemical mixture, recently trademarked as Nanocodes, that can be converted to Data Matrix information through software. The accompanying intellectual property is protected by ten patents, several of which are licensed. Direct marking Data Matrix on NASA parts dramatically decreases data entry errors and the number of parts that go through their life cycle unmarked, two major threats to sound configuration management and flight safety. NASA is said to only have people and stuff with information connecting them. Data Matrix is one of the most significant improvements since Challenger to the safety and reliability of that connection.



UID & eBusiness Forum

Implementation Strategies for Programs & Suppliers

SPACE

UID...Now That's Gonna Leave A Mark

UID & eBusiness Forum

Arlington, VA

February 26, 2008

Fred Schramm

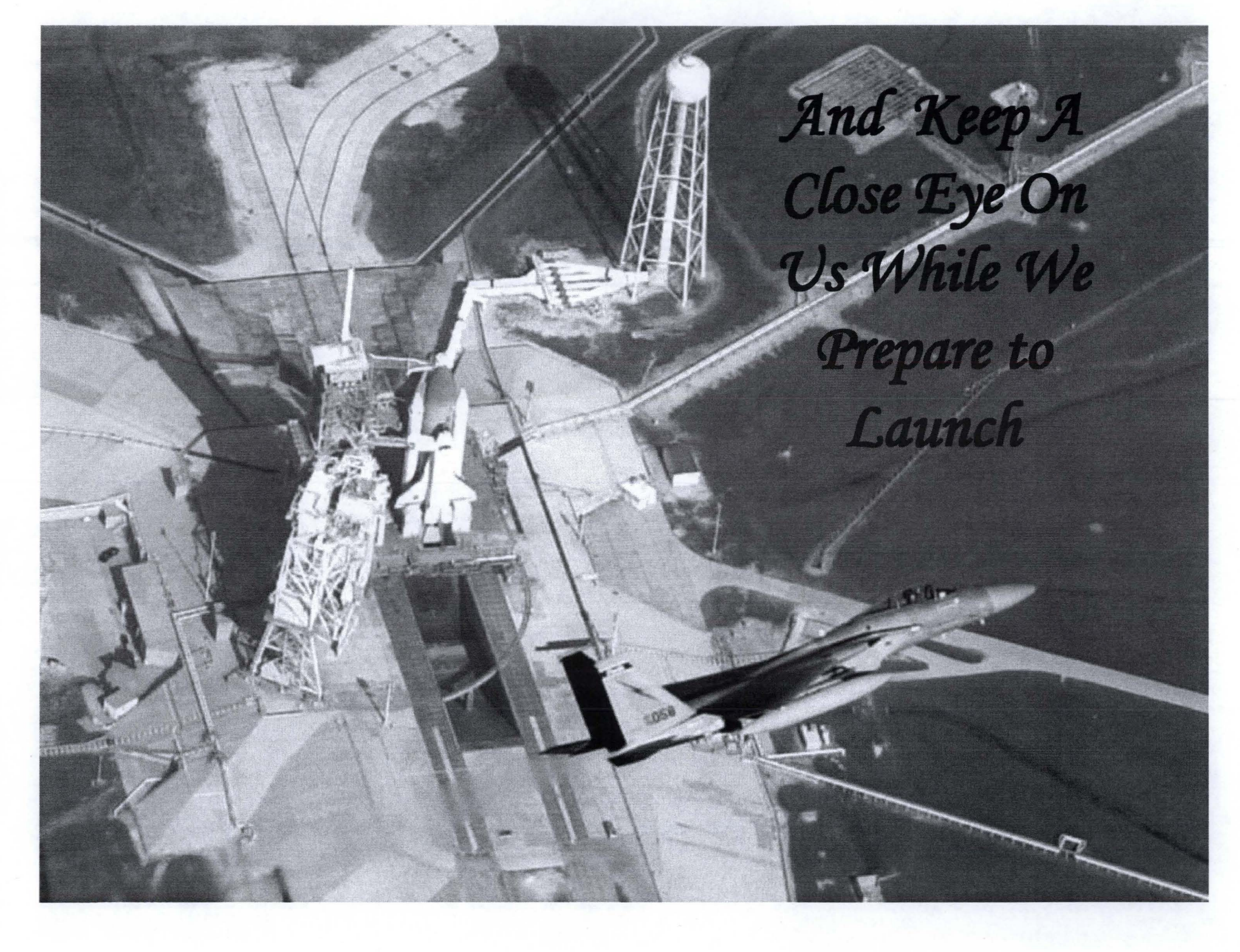
**National Aeronautics and Space
Administration**

**Marshall Space
Flight Center**



A grayscale image of the American flag, showing the stars and stripes in a slightly wavy, draped manner. The stars are on the left side, and the stripes flow across the rest of the frame.

*NASA Thanks Those Who
Protect Our Freedom
Global, Homeland, Hometown*

An aerial, black-and-white photograph of a space shuttle launch complex. In the foreground, a jet fighter aircraft is parked on a tarmac, angled towards the right. The tail of the jet has the number '0058' visible. In the background, a large space shuttle is being mated to the external tank and solid rocket boosters on a mobile launcher platform. This assembly is being moved by a large crawler-transporter along a set of parallel tracks. To the right of the tracks, a tall, slender service structure stands. The surrounding area includes various support buildings, parking lots, and roads. The text 'And Keep A Close Eye On Us While We Prepare to Launch' is overlaid in a stylized, cursive font in the upper right portion of the image.

*And Keep A
Close Eye On
Us While We
Prepare to
Launch*

*While We Tip Our Wings
Goodbye
To Each Other*



And As We Return Home





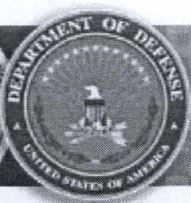
The UID Program Directive

*We Were Given Mountains
to Learn How to Climb*

A black and white photograph of the Space Shuttle Challenger in orbit. The shuttle is on the left, angled upwards, with its white thermal protection tiles and dark-colored nose cone visible. The Earth's surface, showing a pattern of clouds, is visible in the background on the right.

*Space
Help*

*UID Forums...
.....Trying to Help
Solve the Problems*



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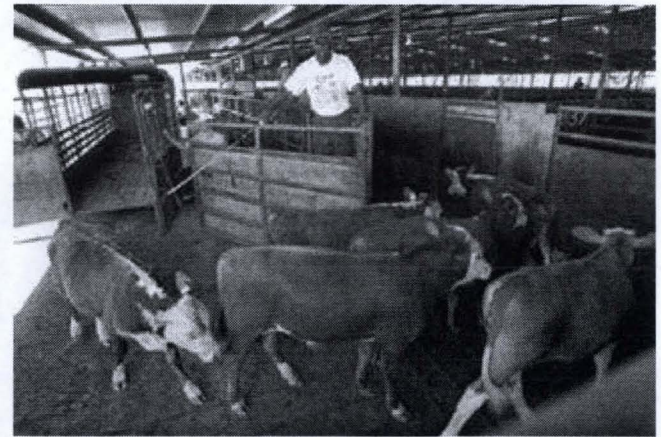
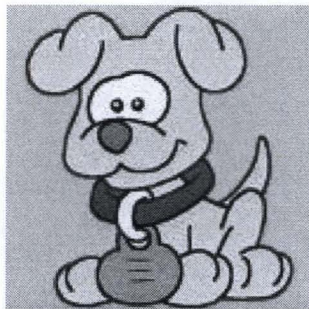
Implementation Strategies for Programs & Suppliers

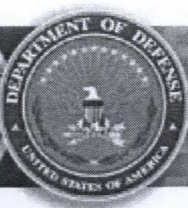
**Today's World....More Things Being Tracked
.....For Safety
.....And Because We Can**



United States Department of Agriculture

**NEW NATIONAL ANIMAL ID SYSTEM
WILL GUARD AGAINST MAD COW DISEASE
AND ANIMAL HEALTH PROBLEMS**



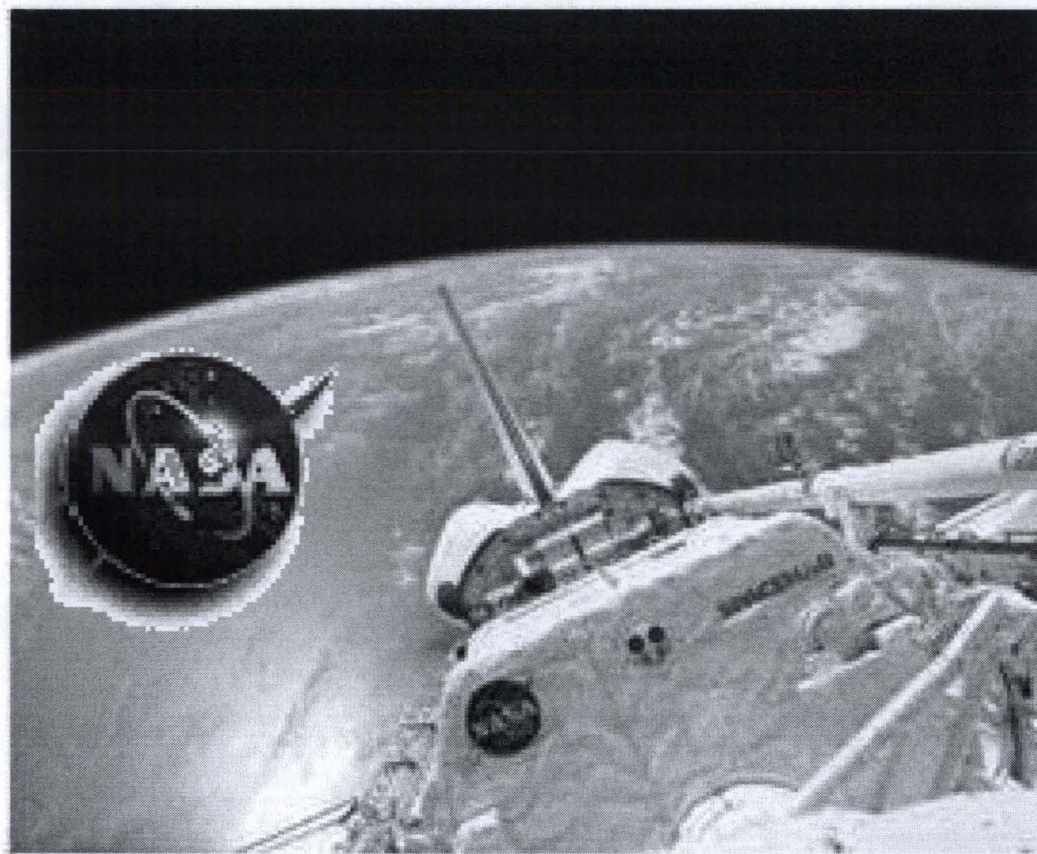
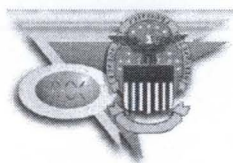


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Different Organizations Track Products for Different Reasons

Readiness UID



2008

ARLINGTON

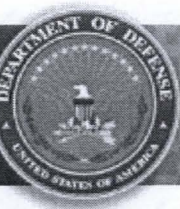


HUNTSVILLE



SACRAMENTO

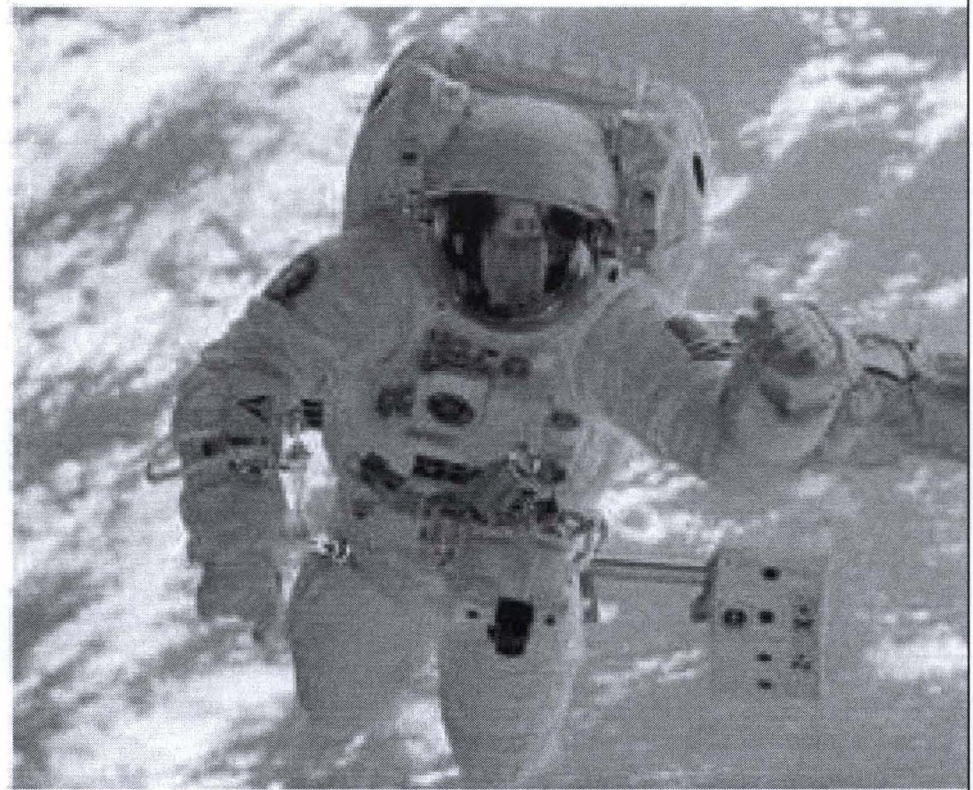
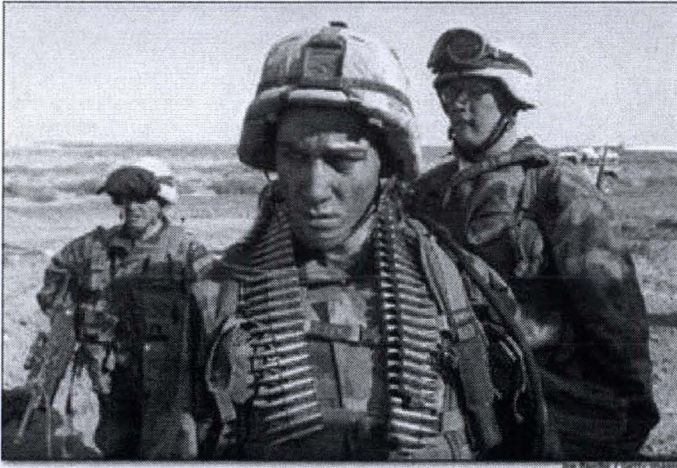
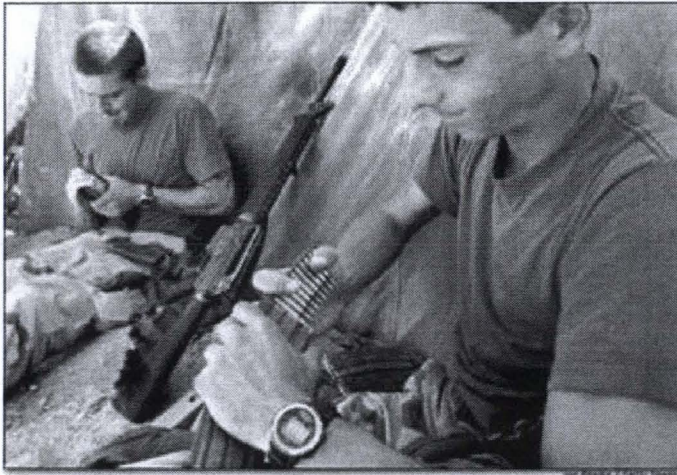
2008

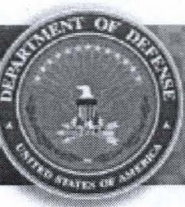


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UID... Tracking for a Reason

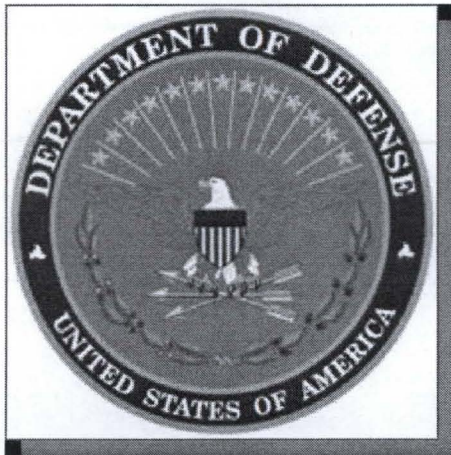




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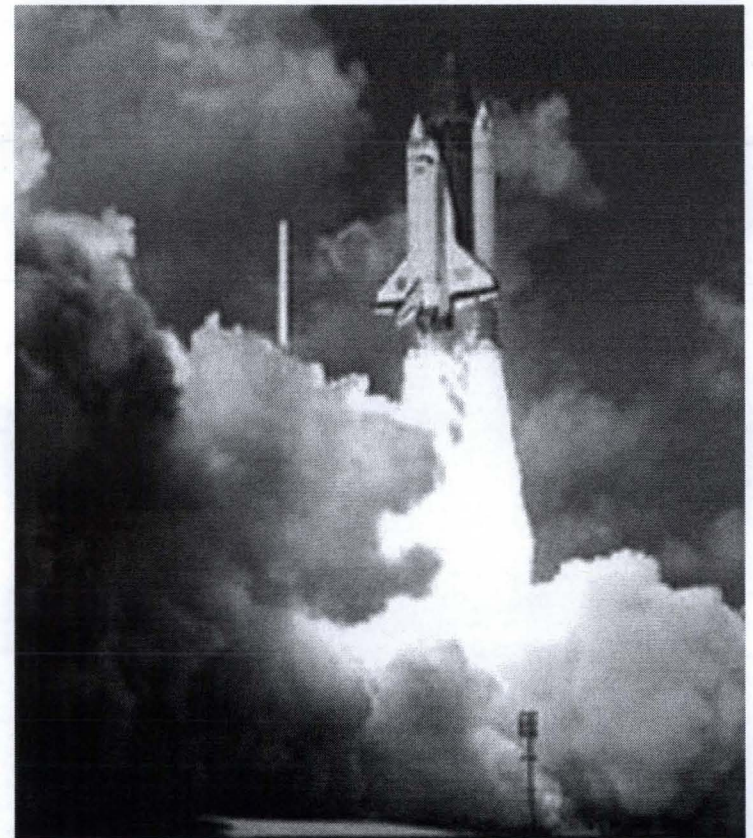
Implementation Strategies for Programs & Suppliers

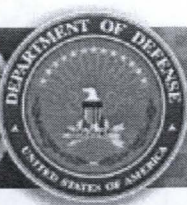
Requirements to Track Products Start with Identification



*Part Numbers and Serial Numbers
Identify One Part From the Other*

*CAGE Numbers Identify One
Supplier from the Other*





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But For Parts with Part Numbers... Automatic Identification Choices



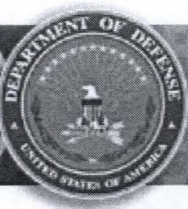
MIL STD 130... Certain Allowances for Parts That See the Easy Life

Bar Code Labels Are Cheap...and Work in Some Applications

Tags and Nameplates Work in Some Applications

If space is limited or permanence required...Use 2D

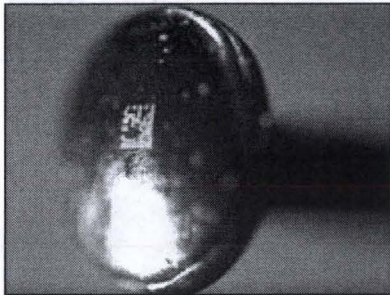




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UID... Direct Part Marking

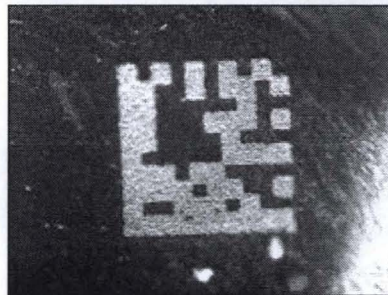


NASA's Primary Emphasis

....Item-Level Traceability Requires UID

....MIL STD 130/NASA STD 6002C

use same symbol format



**Left: 10x10 matrix symbol
on the head of a straight pin**

**Below: 10x10 matrix symbol
on the side of a turbine blade**

Know the Pedigree

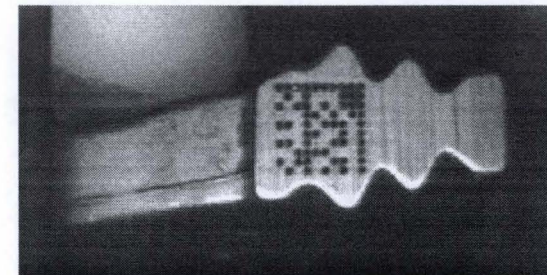
....Know who made it

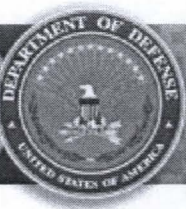
....Know who marked it

....Know who stands behind it

A properly engineered and applied mark is a:

FLAWLESS IMPERFECTION



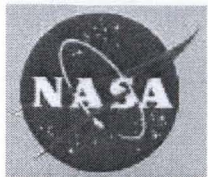


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http://maptis.nasa.gov/NASA_MP_COP.html

NASA Materials and Processes Community Of
Practice



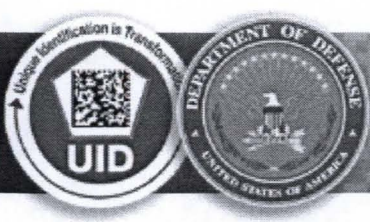
Registered User Login

WARNING

This is a United States Government computer. This system is for the use of authorized users only. By accessing and using the computer system you are consenting to system monitoring, including the monitoring of keystrokes. Unauthorized use of, or access to this computer system may subject you to disciplinary action and criminal prosecution.

**To apply for access to this site,
click here: [Application for Access](#)**

System Requirements: Internet Explorer 6.0 or Netscape 7.1 on a Windows XP operating system with a resolution no less than 1024x768.

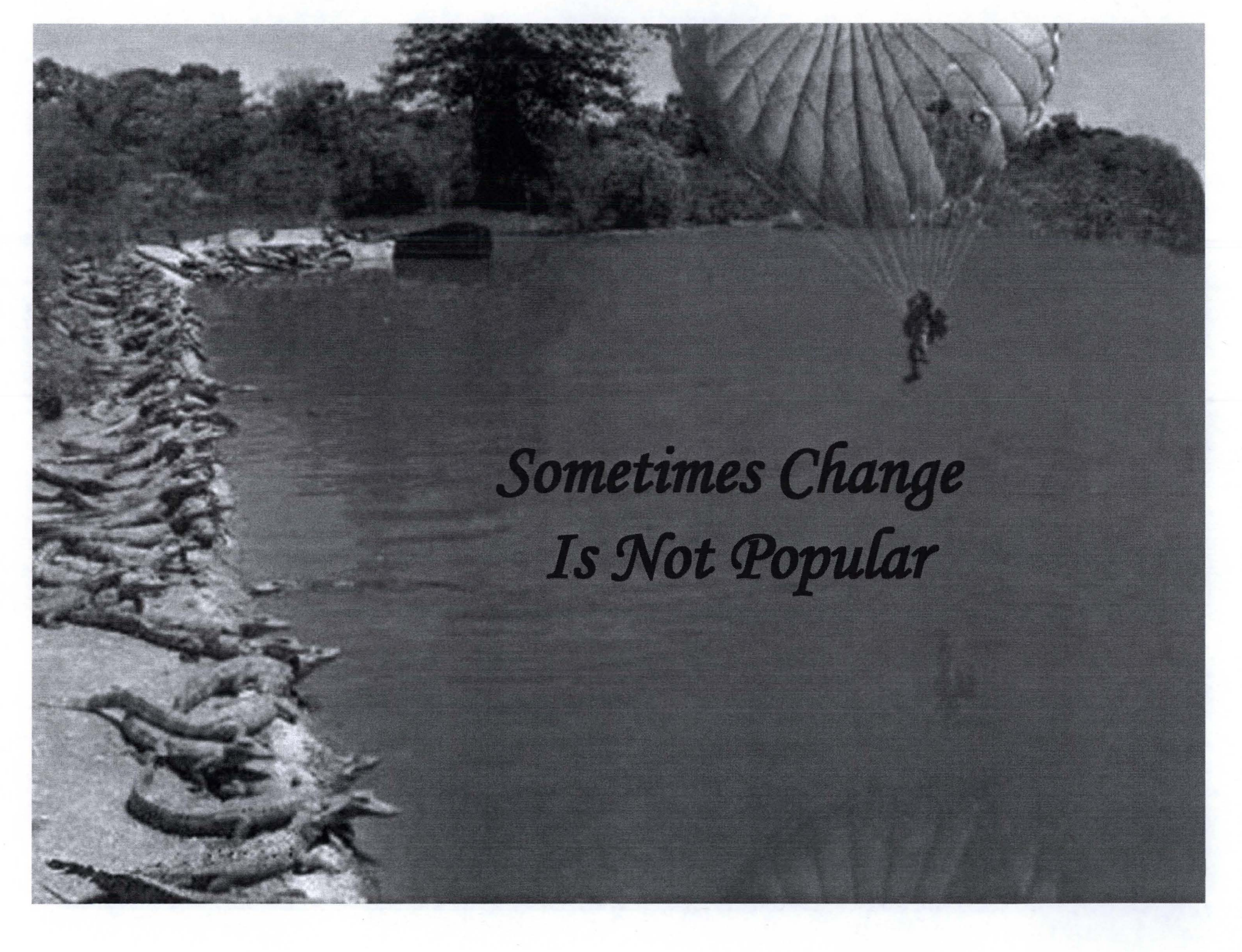


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UID... Direct Part Marking and Reading

What to Expect

A black and white photograph showing a person parachuting over a body of water. The parachute is large and light-colored, with the person hanging below it. The shoreline on the left is crowded with many crocodiles, looking towards the water. The background shows a line of trees.

*Sometimes Change
Is Not Popular*



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Symbols Covered with P

- Items That Can Not Be Marked at All

*None of Them Are As Hard As Breaking
the Sound Barrier*



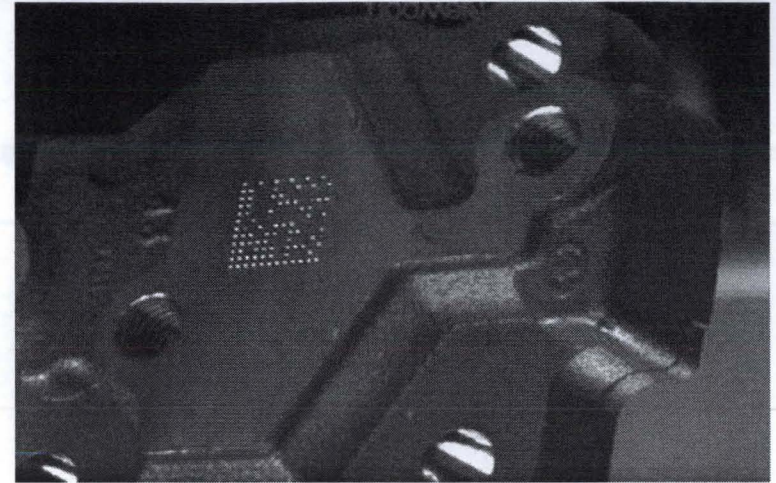
*And You Do
That Every Day*



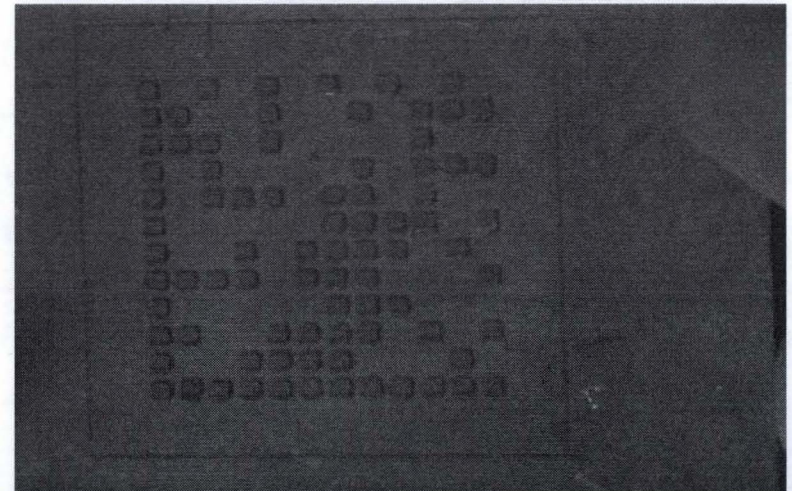
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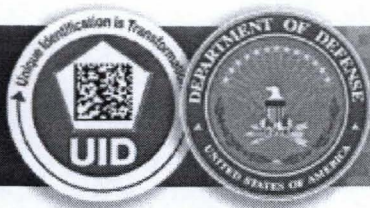
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UID...From Easy to Difficult



**Engine Block...
No Contrast Data Cells**



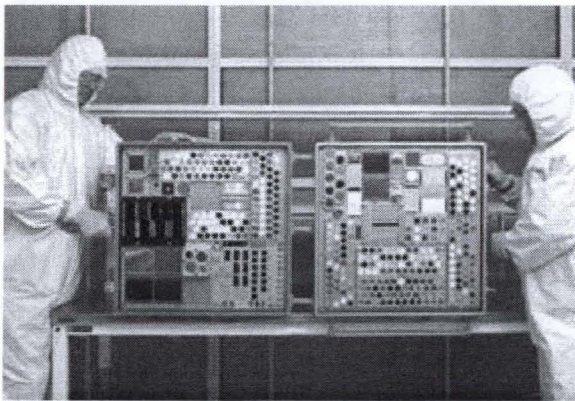


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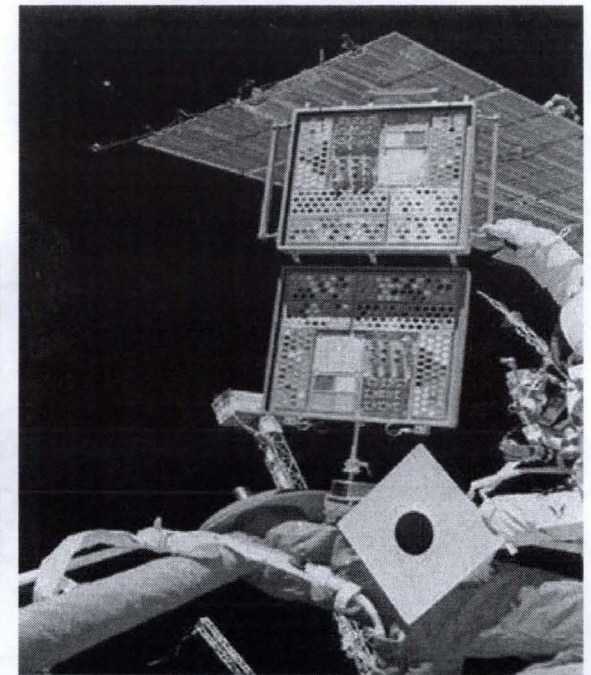
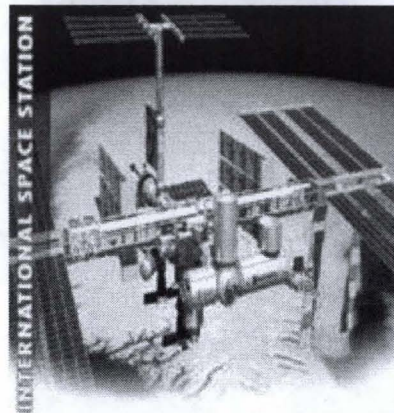
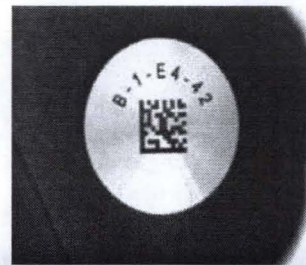
Implementation Strategies for Programs & Suppliers

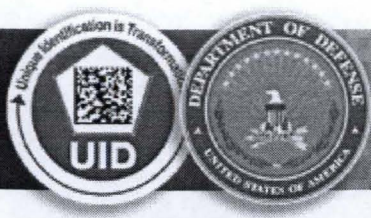
Materials-International Space Station-Experiment 1 & 2

MISSE- Tested for Long Term Space Exposure



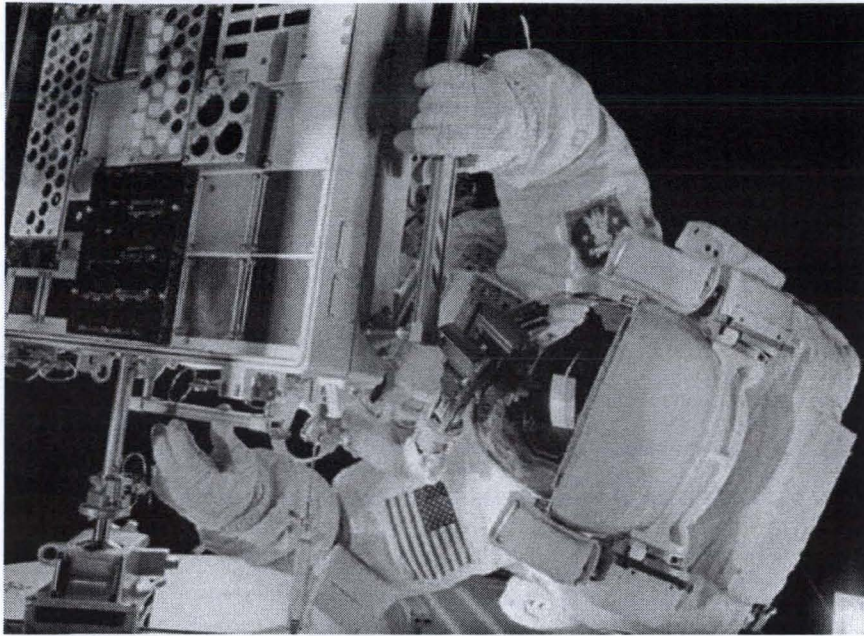
**The Plan Was To Expose
The Samples to Space
For A Year...But the test
concluded 4 years later**



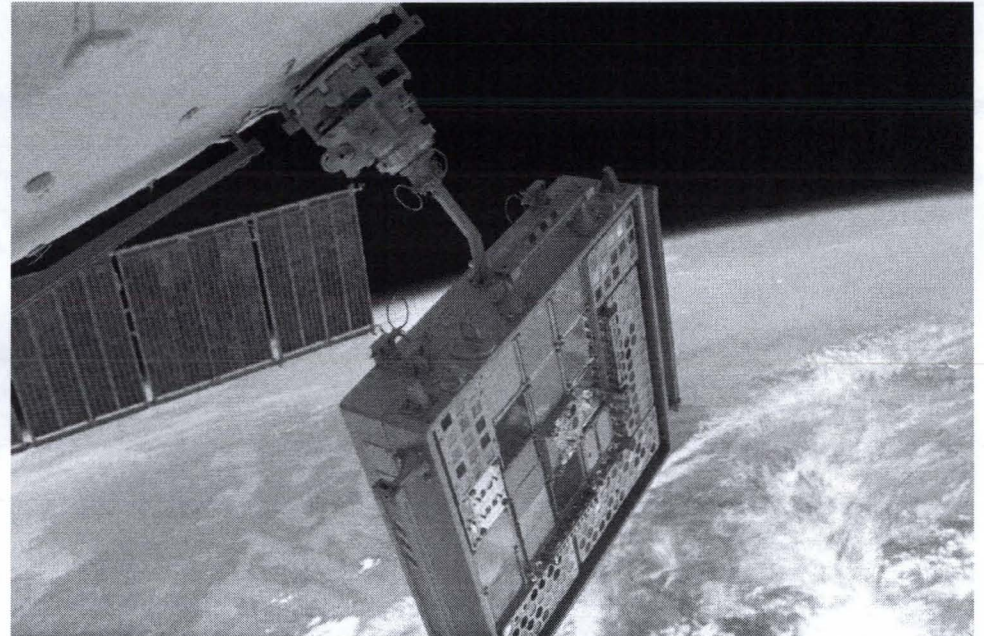


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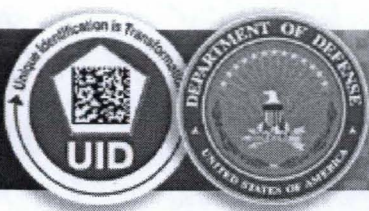


MISSE 1 & 2



MISSE 3 & 4

**All Samples Came Back and Were Analyzed
Results Will Be In NASA STD 6002 in 2010**



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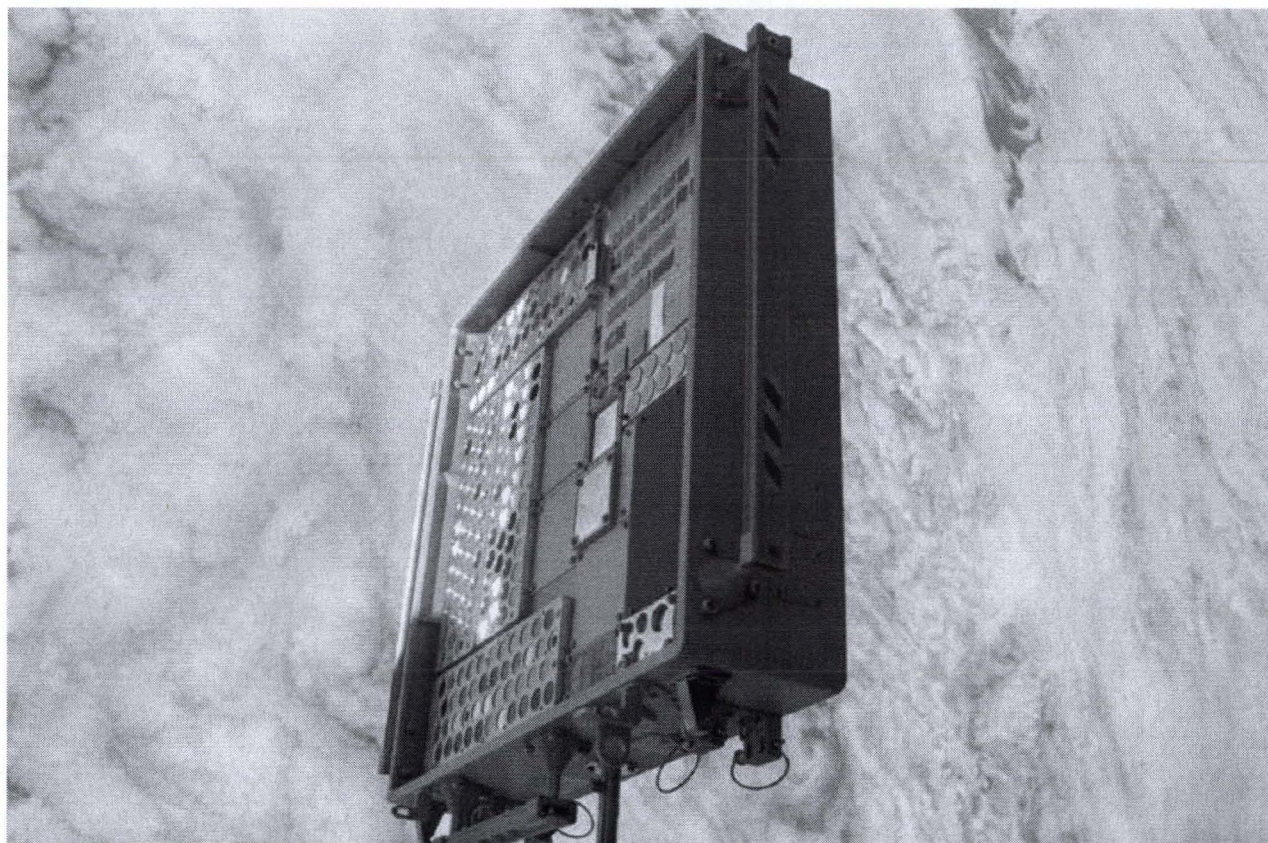
Tests for Long Term Exposure to Space (MISSE 6)

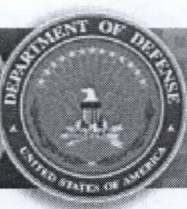
**Carries laser bonded
Data Matrix samples**

**Carries Nanocodes™ in
various coatings and one
dot peened into coupon**

**Carries one paper RFID
tag and one encased in
plastic—attached to face
of tray**

**Scheduled to
launch aboard Endeavor,
early 2008**

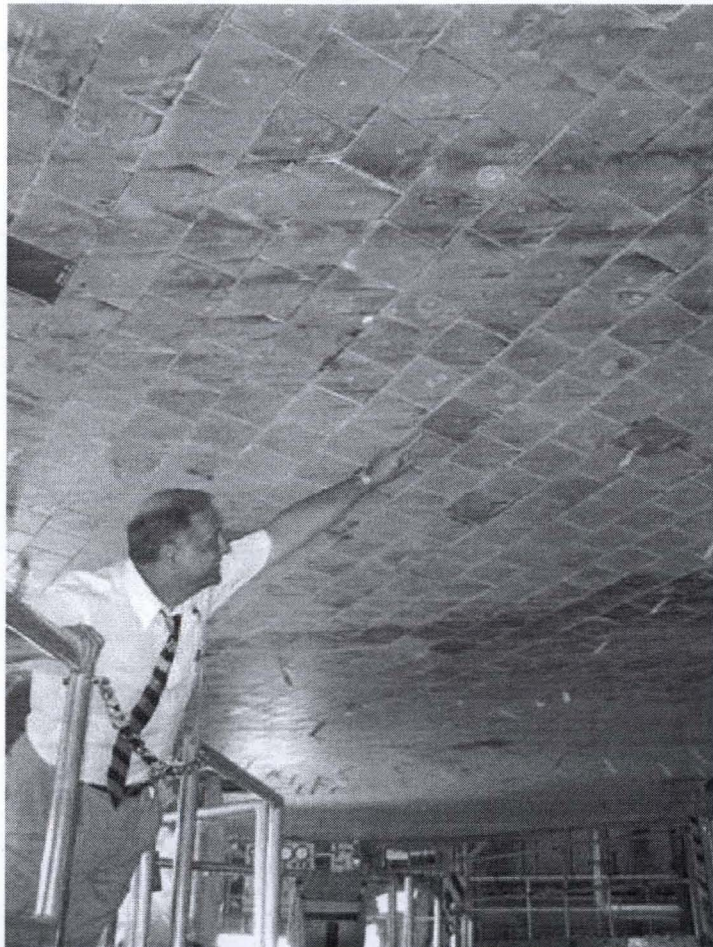




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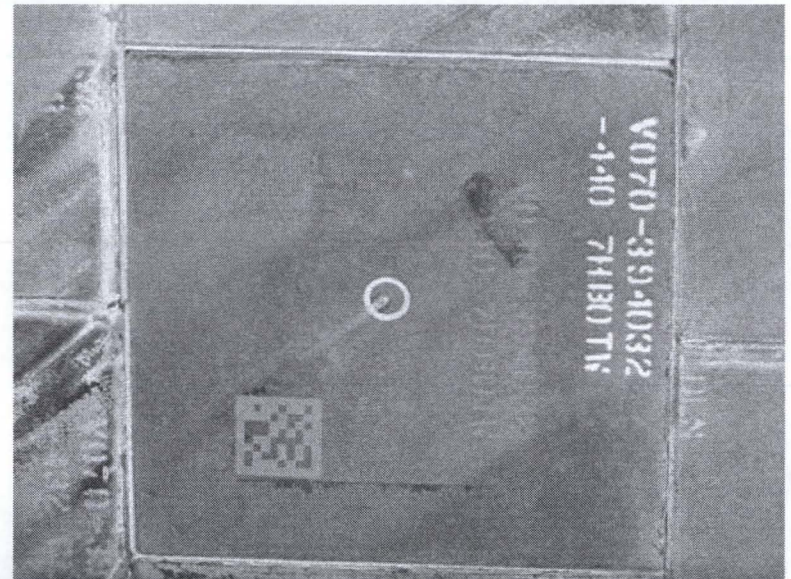
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Tests for Repeated Exposure to Extremes



Thermal
Protection
System--
3 Marked
Shuttle Tile
Remain

19 Times in
Space
on OV-103
(Discovery)



Looking Good
And
Readable

2008

ARLINGTON



HUNTSVILLE



SACRAMENTO

2008

Ares I and V Launch Vehicles Built on Proven Systems

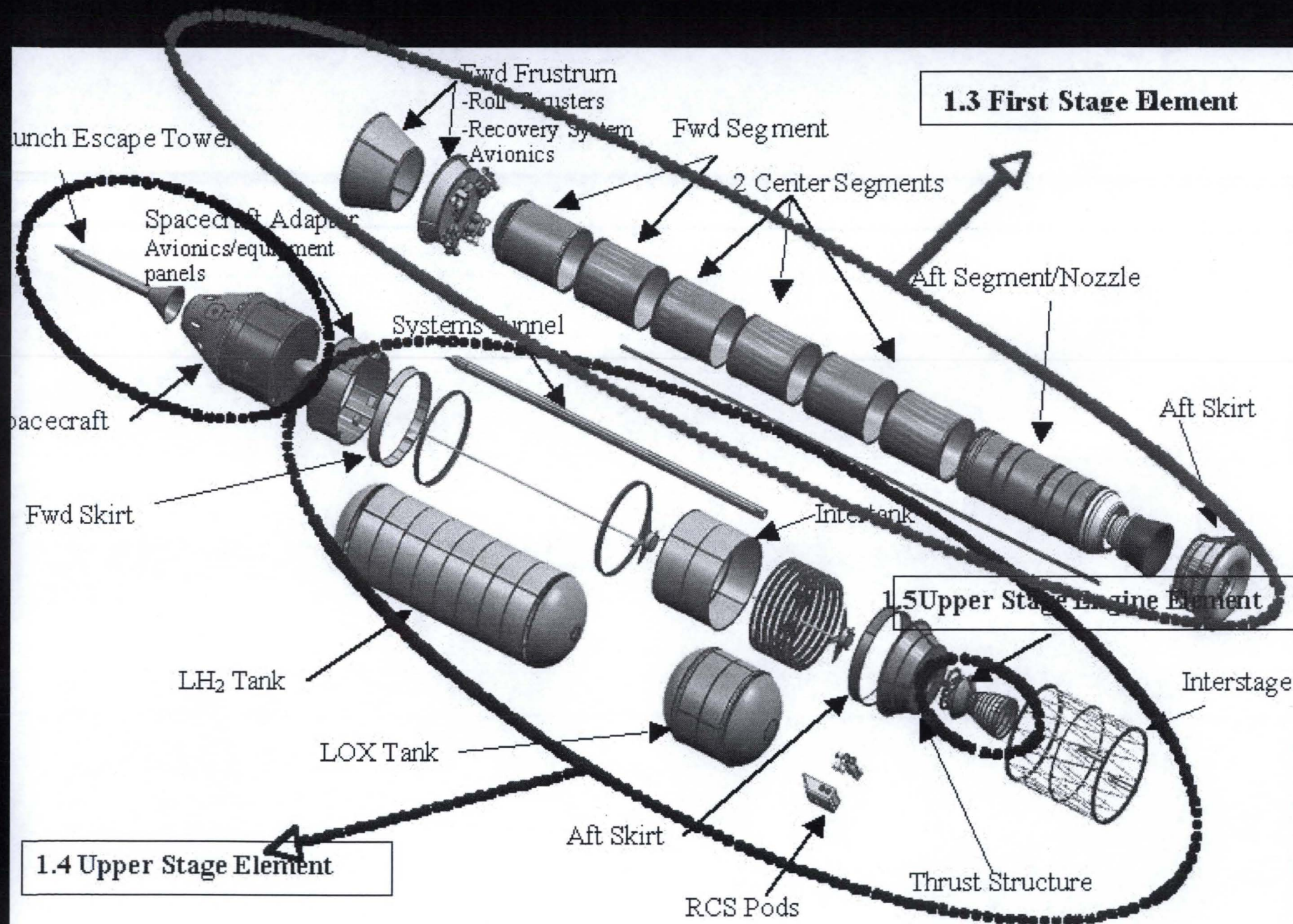


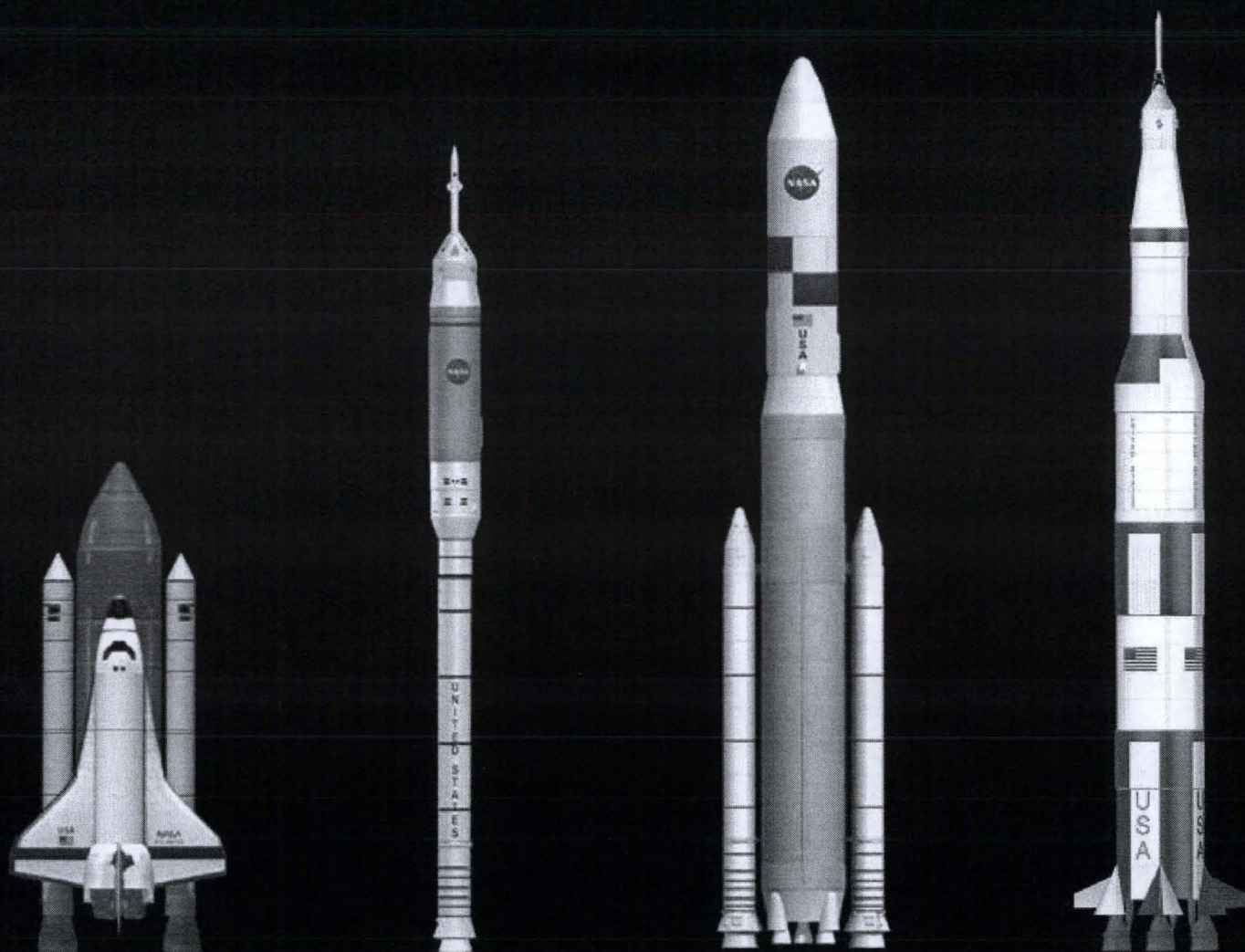
*Ares I
Crew Launch
Vehicle*

New
Problems

New
Opportunities

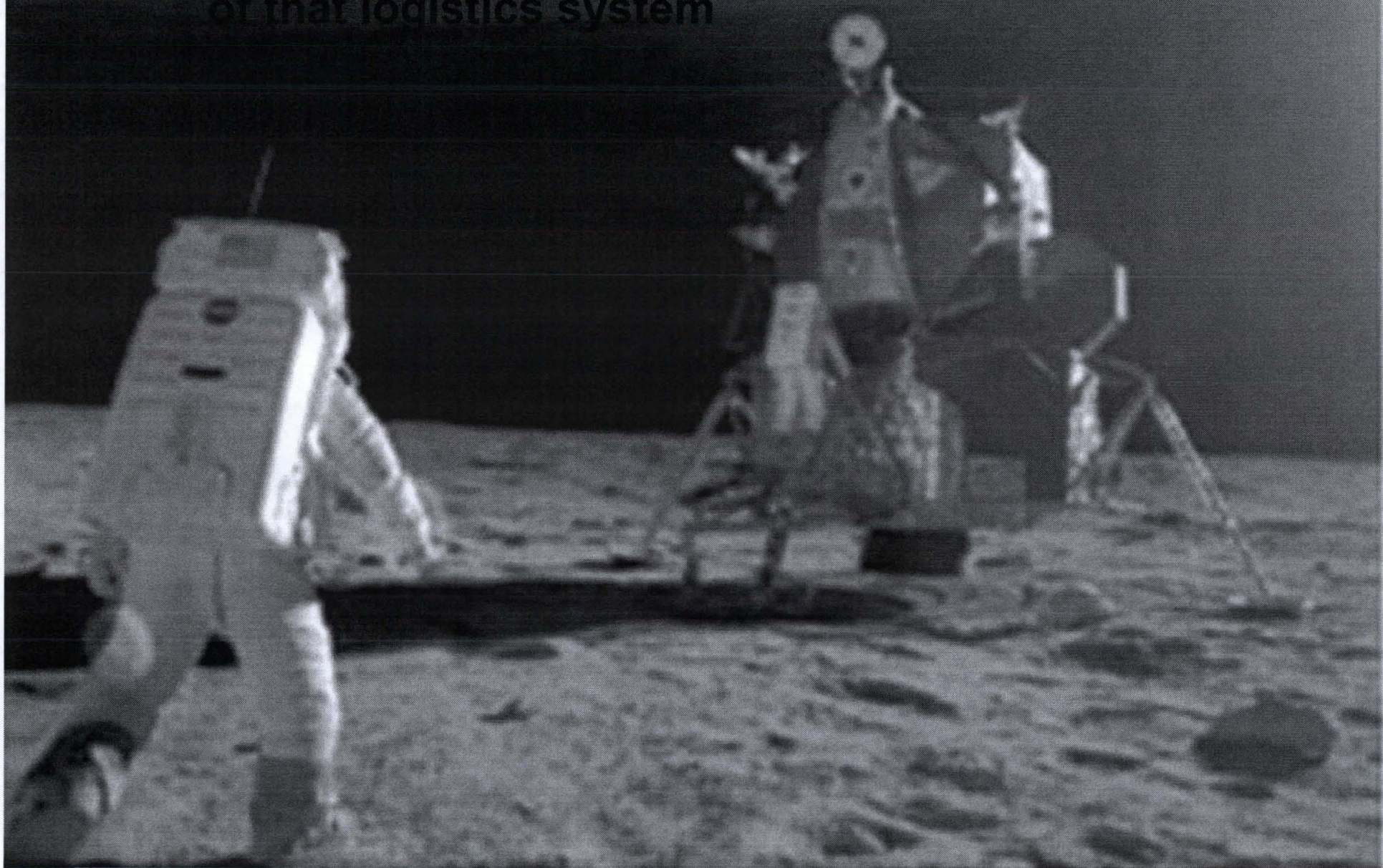
Marshall launching a new era of space exploration



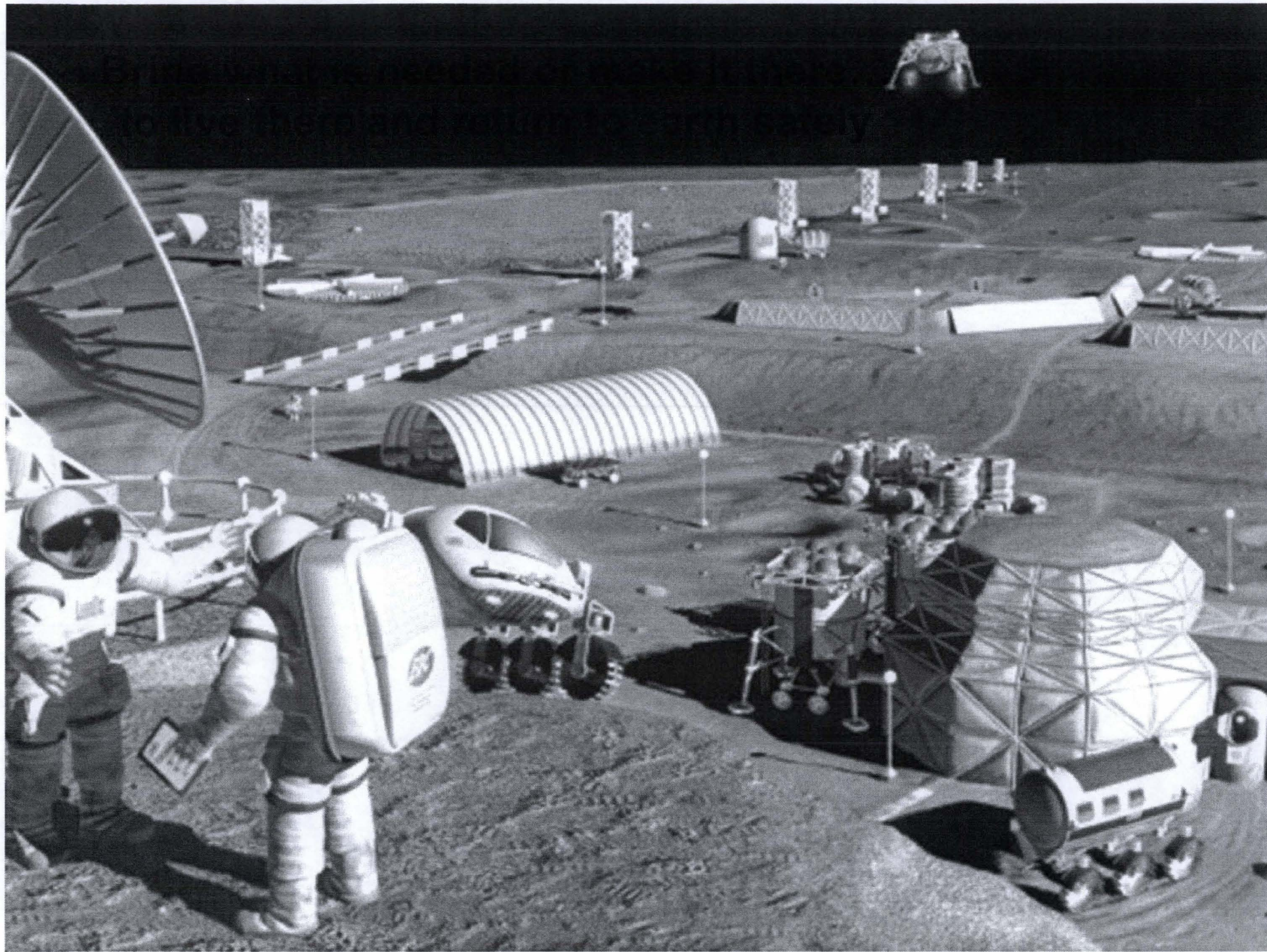


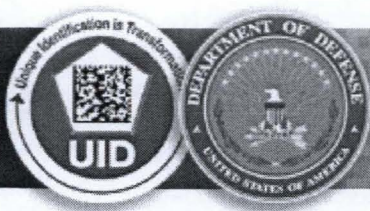


Think of the people whose lives
will depend on the accuracy
of that logistics system









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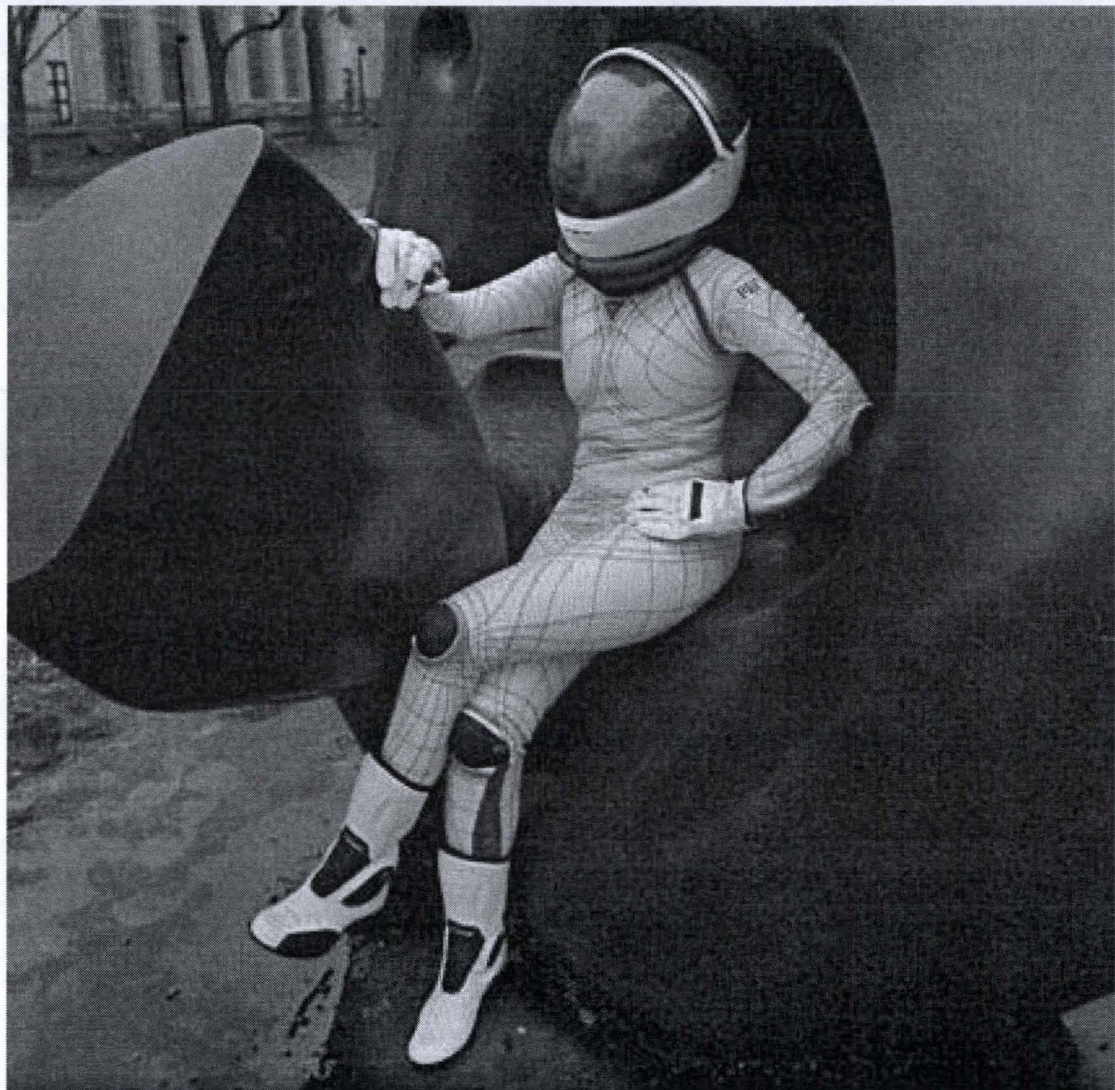
Space Suits

May Even Be

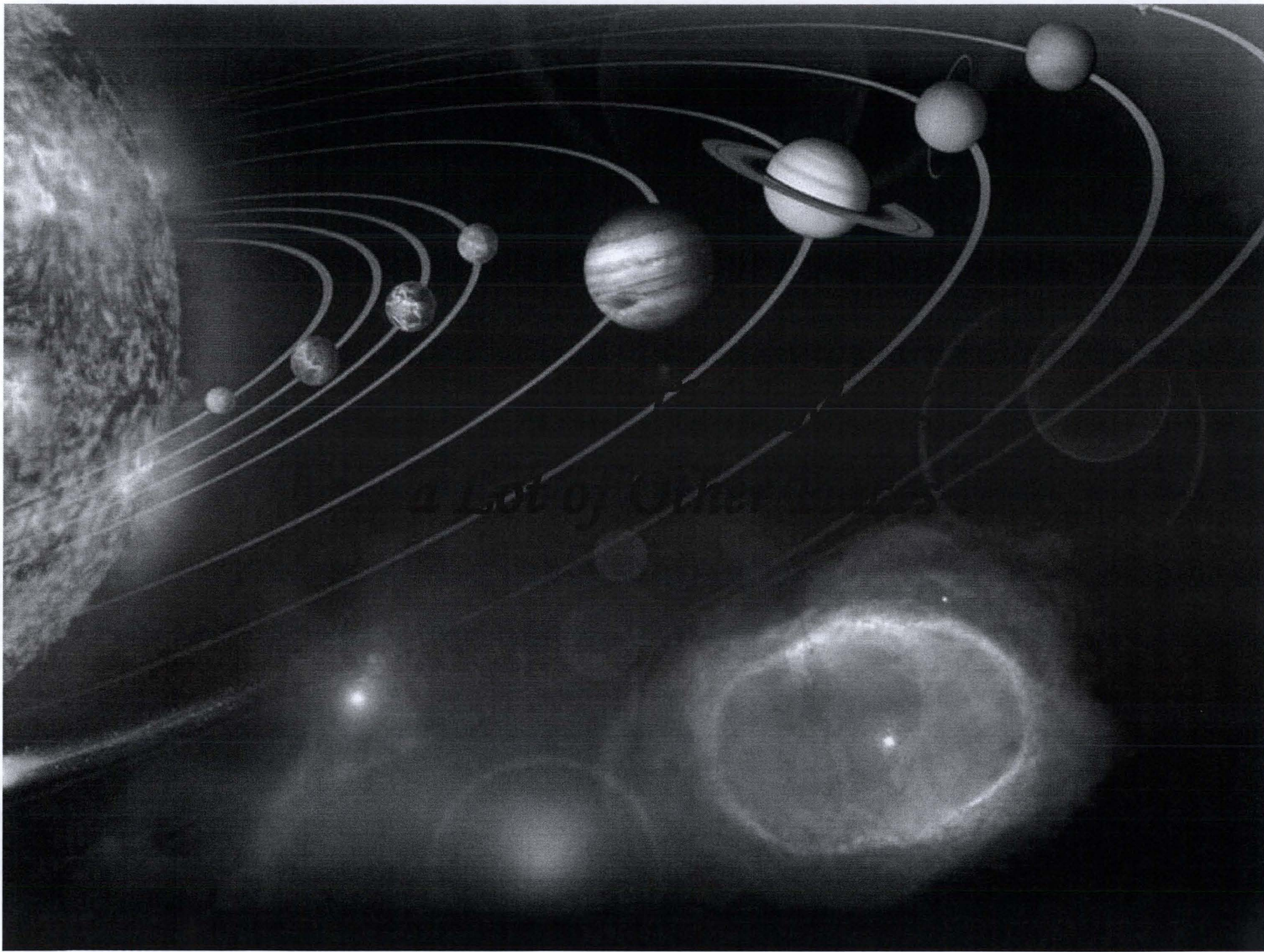
More Functional

And

More Fashionable







a lot of other stuff

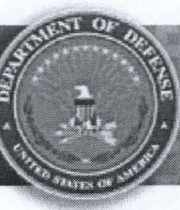


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Jungle, Sand or Space... UID Presents Some Direct Part Marking and Reading Problems

Some Emerging Solutions

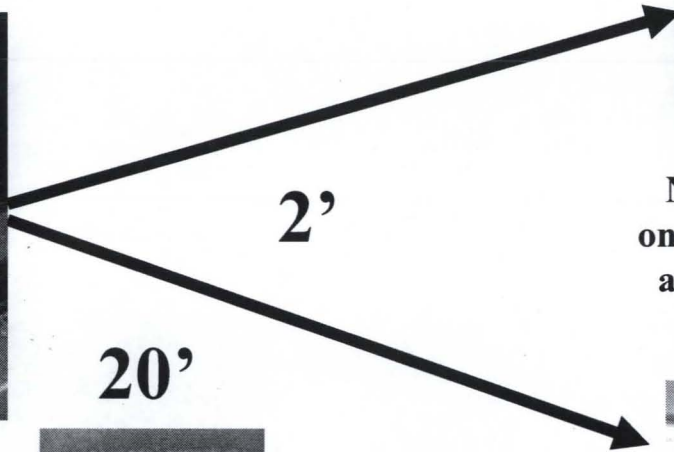
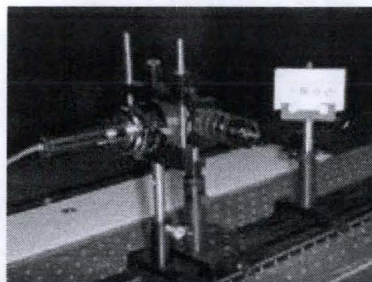
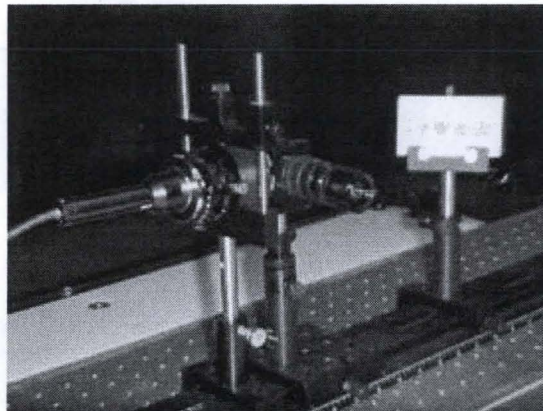


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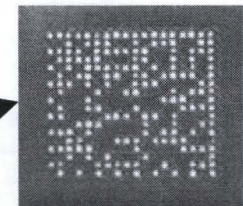
Distance Reading Remedy... Space Station Technology Spinoff

NASA Optical Scanner For Visible Marks

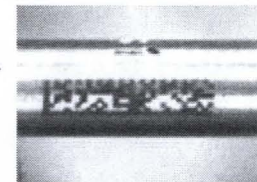


2'

20'

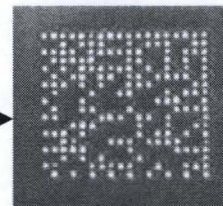


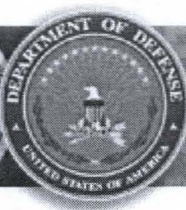
No contrast mark
on smooth aluminum
at 30 degree angle



Shiny screwdriver

60'





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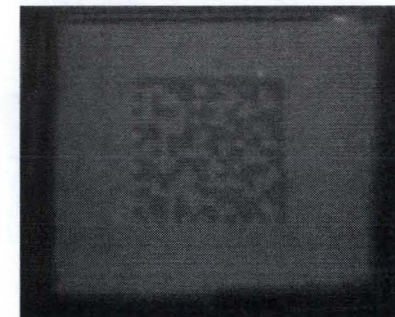
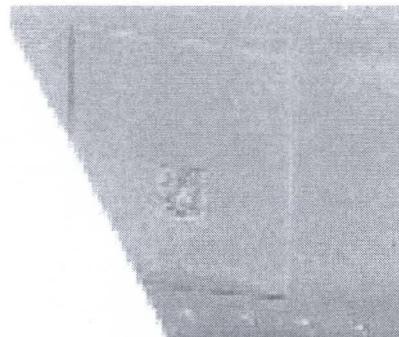
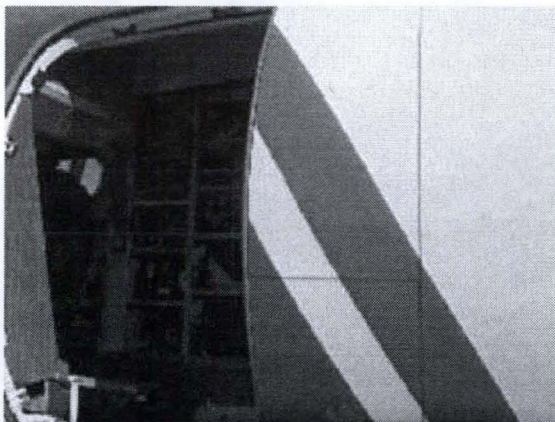
Painted Part Remedy... Space Shuttle Technology Spinoff

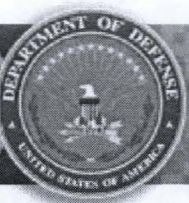
*Mark survived
24+ months of
Coast Guard duty*



*Magnetic
Scanner*

*Mark decoded
through 6
layers of paint*



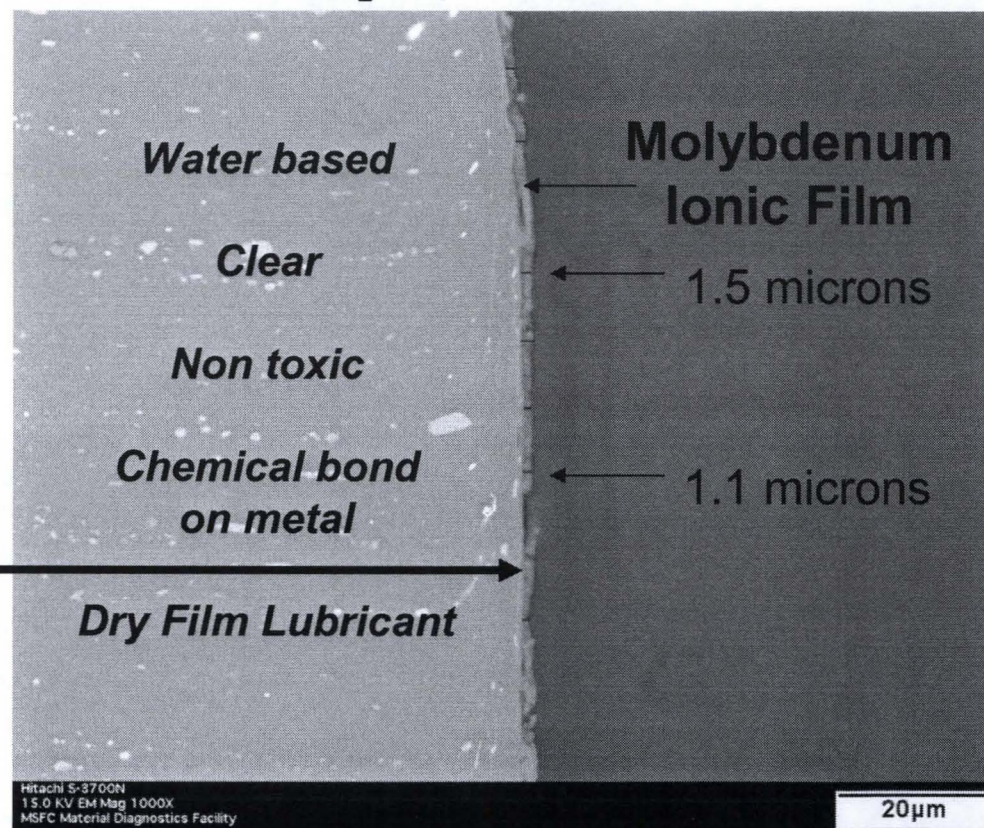
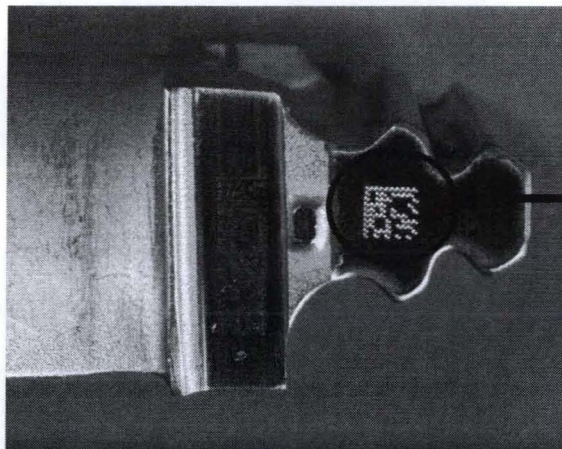


UID & eBusiness Forum

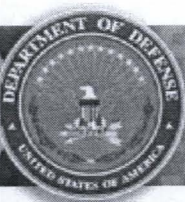
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Visible Mark Protection Remedy... Ares I Infusion Spinoff

Ionic Dry Films
Nanoclusters



Mo_c04_1000xm.tif



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UID...Encounters the Unmarkable Part

NanocodesTM = the mark (a chemical bar code)

		Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
		48	51	52	55	56	59	58	63	64	69	72	73	76	79	84		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
85	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	
Fr	Ra	Ac	Rf	Ha	Sg	Ns	Hs	Mt	Uun	Uuu								
125	126	127							128	129	130							
		Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
		20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

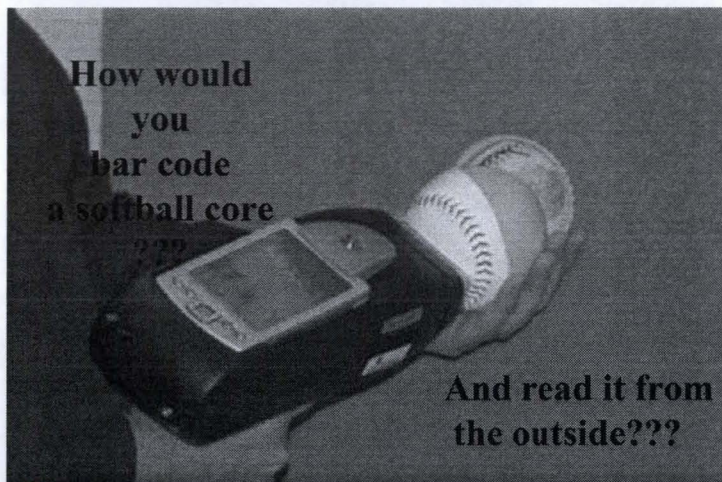
=> **Conversion**



X-ray fluorescence
is the reader

Matches to the
Supplier Code

Software converts
to ASCII





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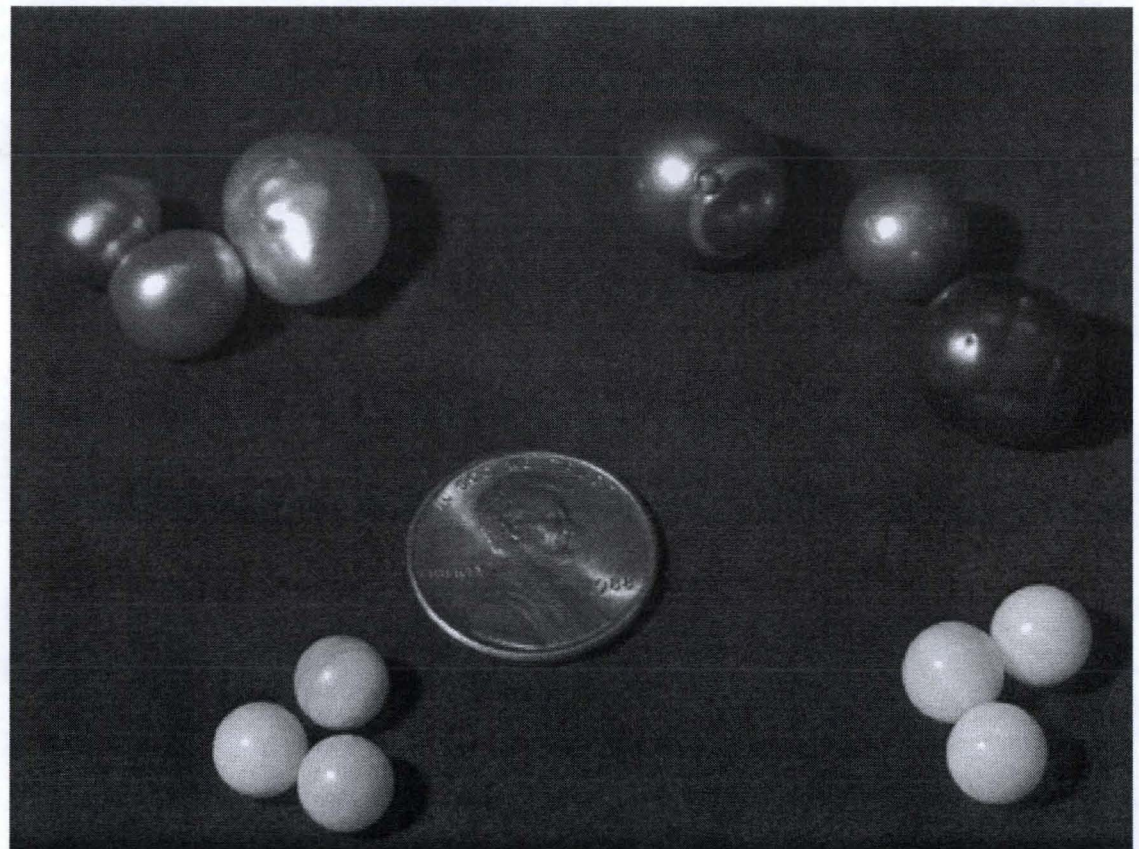
Implementation Strategies for Programs & Suppliers

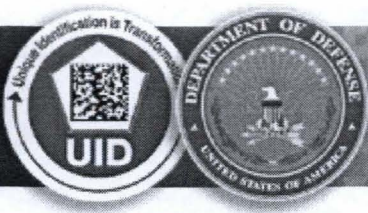
UID...Encounters the Unmarkable Part **Nanocodes**™

*How would you
do it ???*

Bar code a cultured pearl...
on the seed...
without a surface change...
plant it in an oyster

Then read the bar code
two years later when
the pearl is formed....



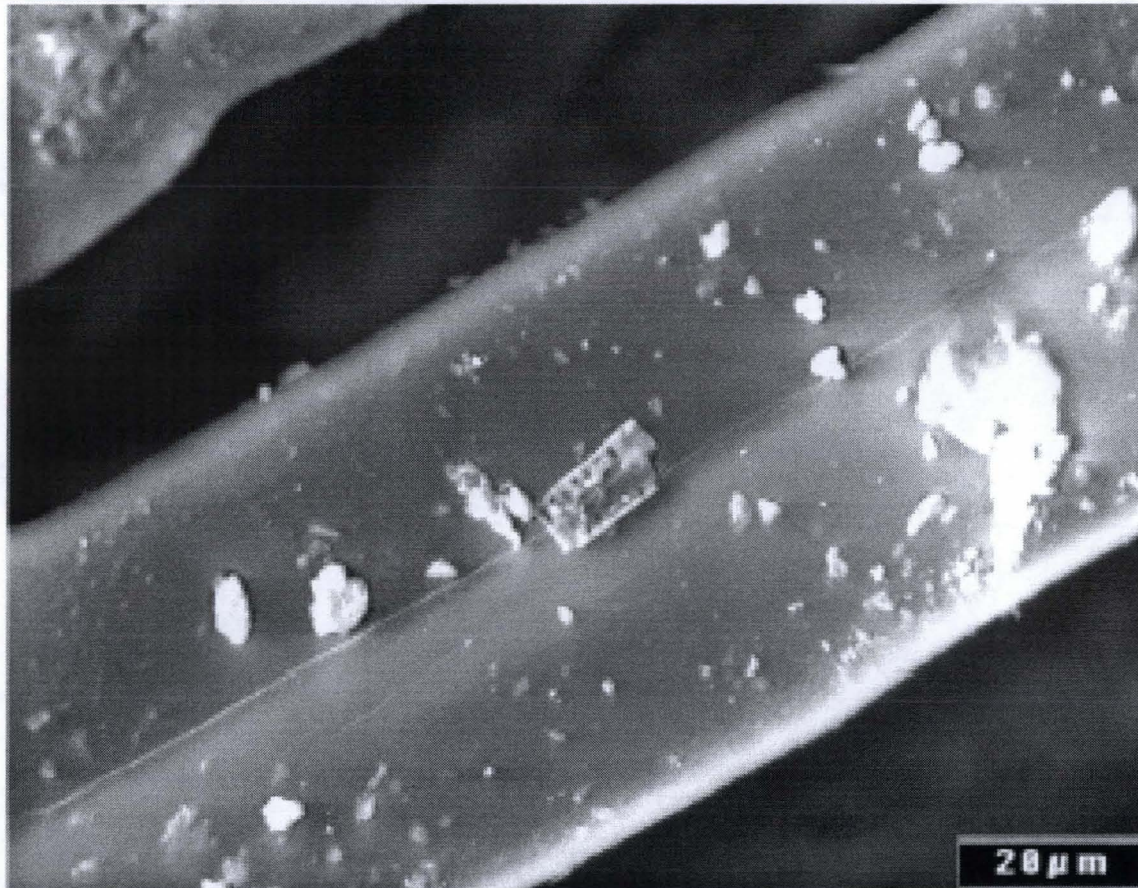


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Nanocodes™

How would you bar code a carpet fiber ???





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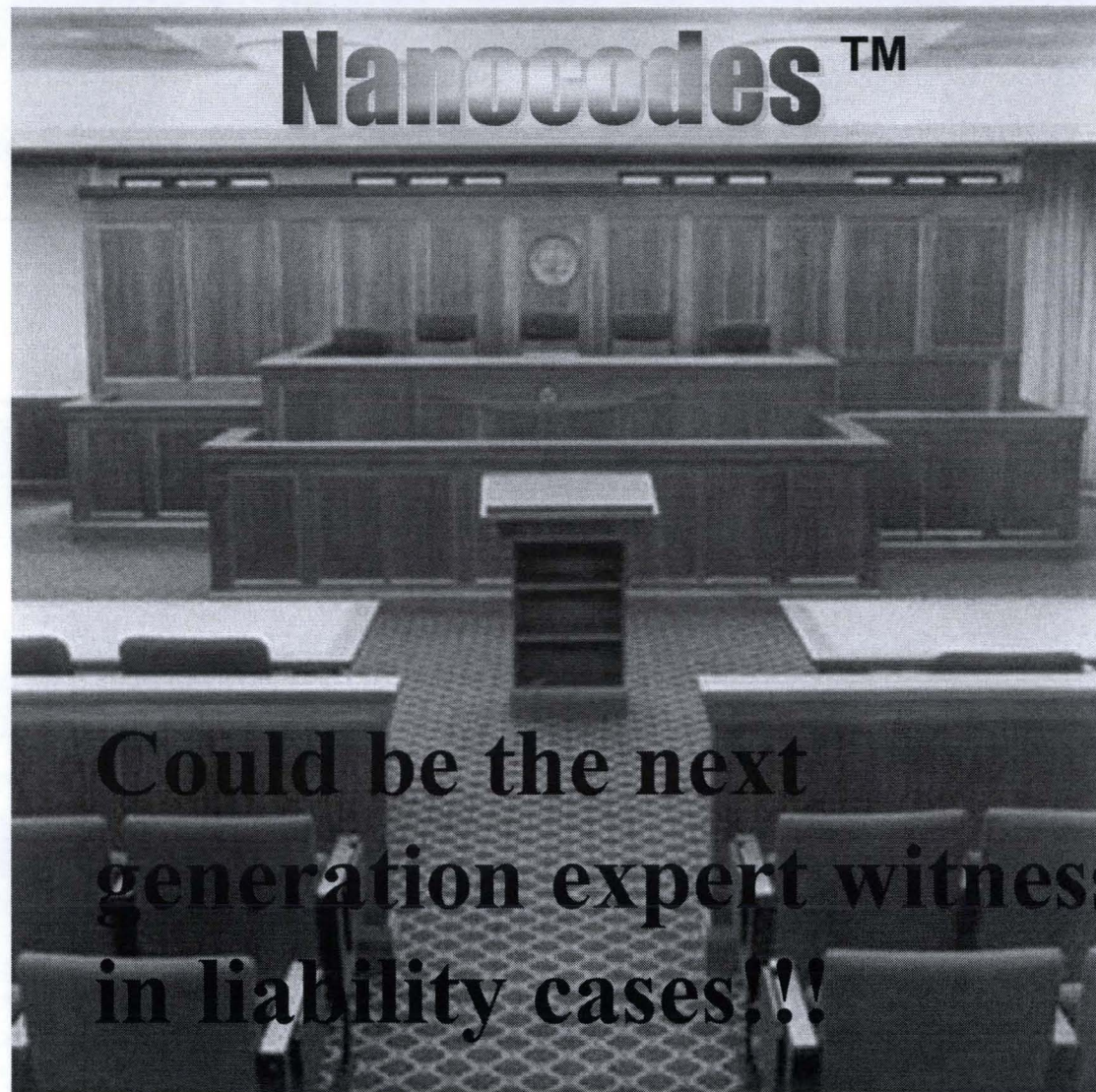
Implementation Strategies for Programs & Suppliers

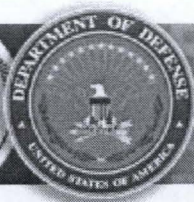
*How does an OEM prove that
the part that failed was
not made by the OEM?*

The Nanocode™ is read to
authenticate the product

Converted format is
transparent to IT systems

Elemental tag pattern
equals internal UID

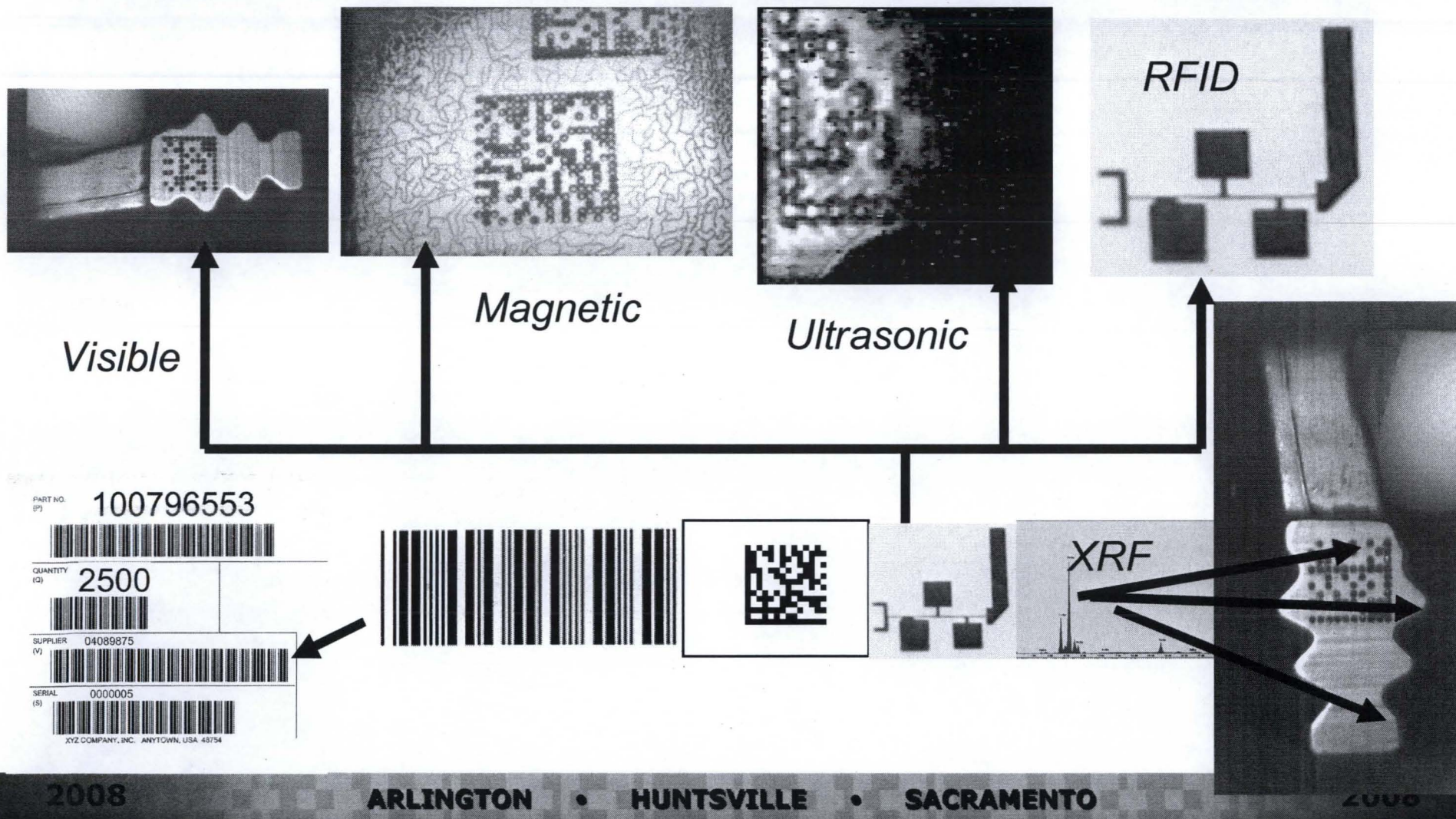


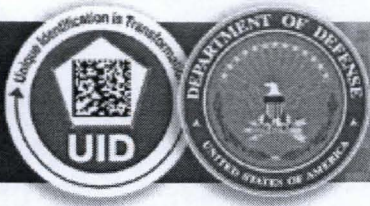


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Validation and Authentication Fully Integrated

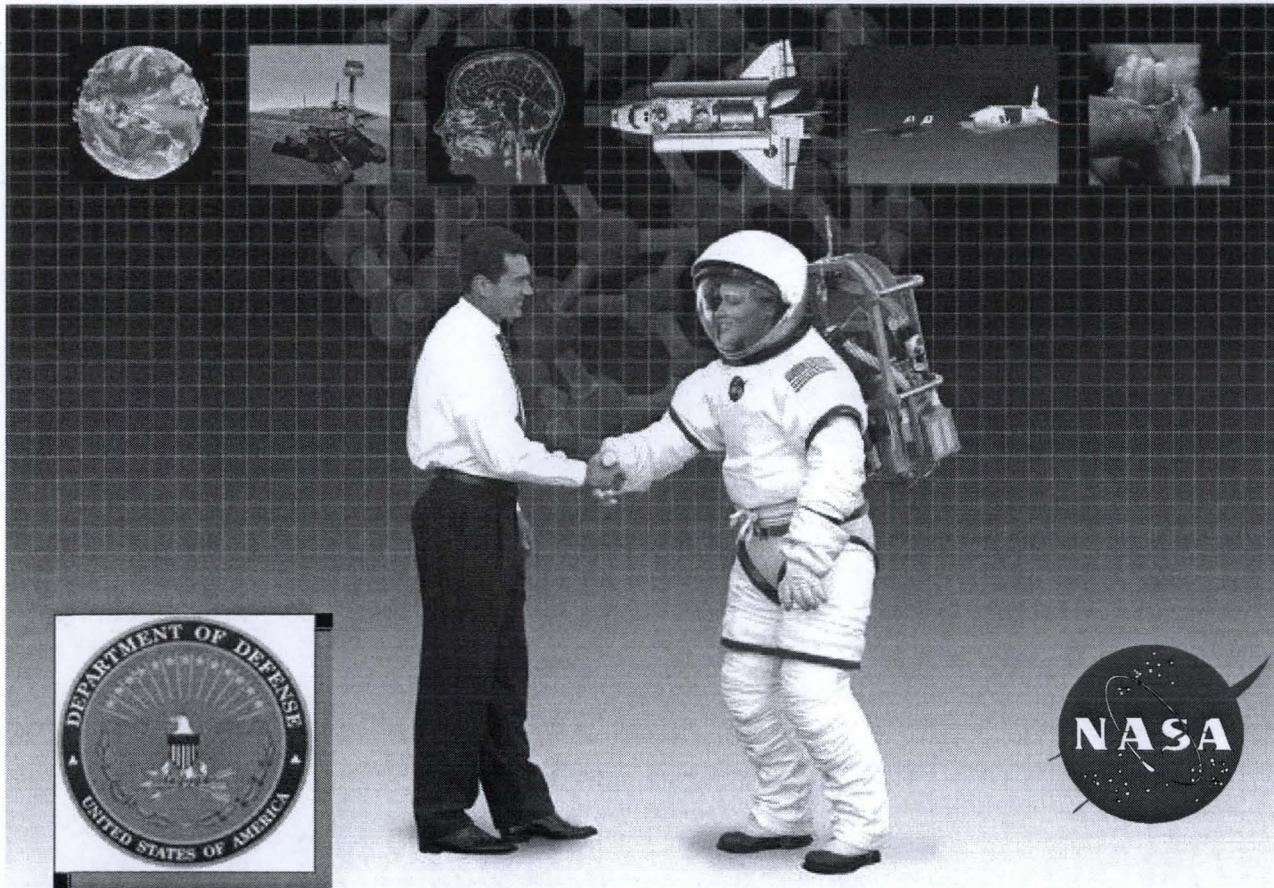




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UID...A System That Starts With Part Identification



*And Succeeds
When People
Work
Together*

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